LAPLATTE RIVER, VT

TECHNICAL MANUAL FOR THE SNR WATER RESOURCE RESEARCH CENTER (WRRC) - COMPUTERIZED DATA MANAGEMENT SYSTEM (CDMS) VERSION V3.0 LAPLATTE RIVER WATERSHED PROJECT

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06 Jul 81

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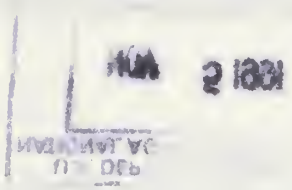

WRRC - COMPUTERIZED DATA MANAGEMENT SYSTEM (CDMS) V5.2
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CHAPTER 1

INTRODUCTION

The Computerized Data Management System (CDMS) is a system designed to capture, process, and generate reports on data from the Laplatte River Watershed Project (see note). The system was designed and implemented by the author of this document to meet the specifications supplied directly by Donald W. Meals Jr. and indirectly by Dr. E. Alan Cassel. Supervision has been furnished directly by Charles P. Ciali and indirectly by Dr. Carleton M. Newton.

The data input, initial verification, and some within year processing takes place on a Digital MINC PDP-11/03. This is presently located at 16 Colchester Ave. The data is periodically transfered to a DEC 20/60 computer where it can be further processed and stored on tape. The DEC 20/60 is located at the Academic Computer Center (ACC) of the University of Vermont, in the Cook Sciences building.

The following chapters will explain each of the system components and how they integrate to form the CDMS. Programming conventions will be explained in detail. This will make it possible for a nontechnical system manager to correct minor problems, and for a programmer (using internal documentation) to easily locate code sections and make modifications.

NOTE

> The Laplatte River Watershed Project "is a twelve year project designed to achieve watershed protection and water quality improvement. The study is a cooperative effort of three groups. The U.S. Department of Agriculture - Soil Conservation Service, The University of Vermont School of Natural Resources - Vermont Water Resource Research Center, and The Winooski Natural Resources Conservation District."(1)

CHAPTER 2

THE HARDWARE

The purpose of this chapter is to define each hardware component of the system, and their interrelationships. Detailed instructions on setup and use can be found in the System User's Guide(8).

2.1 DIGITAL MINC PDP-11/03

The micro computer which handles all data entry, verification, editing, monthly and yearly reports. It also sends aggregated data to the DEC 20/60 for permanent storage and further processing.

2.2 DIGITAL VT105 TERMINAL

This is the console terminal to the MINC. Almost all interaction between the user and the computer occurs through this terminal.

2.3 NUMONICS 1224 DIGITIZER

The digitizer is used to trace flow charts and input the flow value at the mid point of each hour. ASCII characters are sent to the MINC via an RS-232 interface and then processed by the CUMS.

2.4 DECWRITER III

This is the printer for the MINC. It is used for all hard copy reports. When connected to the system it is the system line printer.

2.5 HP 7221S PLOTTER

A pen plotter which is used for graphic display of stored data. It is connected to the MINC as a multi terminal. Not implemented under V3.2.

2.6 DEC SYSTEM 20/60

This is the main frame computer which receives the aggregated data from the MINC. Once transfered, the data is stored on magnetic tapes. Further statistical processing can then be carried out on the 20/60. Not implemented under V3.2.

CHAPTER 3

THE COMPUTER OPERATING SYSTEMS

This chapter contains a brief description of RT-11 and TOPS-20, the operating systems on the MINC and 2060 respectively.

3.1 RT-11 VERSION 5B

This is the PDP-11/03 operating system. It is a single user computer system which serves the needs of both beginning and advanced programer. It provides a comprehensive set of operating commands that programmers at all levels use to control system operations. (2) It enables the system developer or manager to do file manipulations, program compiling, link-loading, and program execution. For a detailed description of the interactive commands, system components, and utilities see RT-11 System User's Guide (5). This and other related documentation should be located in the near vicinity of the MINC.

3.2 TOPS-20 VERSION 4

This is the operating system for the DEC SYSTEM 2060. It is accessed by the CDMS from the MINC when file transfer is carried out. This is handled exclusively by the MINC component of the CDMS. The user must establish the hardware connection via a modem, but the MINC portion of the CDMS performs the interaction.

TOPS-20 is further used independently of the MINC portion of the CDMS to perform file storage and retrieval from magnetic tape and across year statistical data processing. For further information about TOPS-20 see the TOPS-20 User's Guide (7) and TOPS-20 Command Reference Manual (6). For more information on its usage in the CDMS see chapter 6.

CHAPTER 4

GENERAL SYSTEM ORGANIZATION

The logical organization of the system is illustrated in figure 1. You will note that there are two major components to the system, the MINC and Dec 20/60 components. The communication which occurs between these components is strictly a one way transfer of data from the MINC to the 20/60. This occurs periodicaly when all the data for a given month has been entered.

The functions which occur on the MINC are all controlled by a single FORTRAN/MACRO program on that computer. A user of this component of the system need not be experienced with computers, while a user of the 20/60 component of the system must be somewhat familier with TOPS-20 and available software packages. The functions illustrated in figure 1 are greatly generalized and will be described in greater detail in following chapters. The functions that will occur on the 20/60 have not been established under version 3.2, and will not be discussed in any detail in this document.

The overall flow of data through the system is depicted in Figure 2. The aim of the system is to merge logically related data, originating from diverse sources into a physicaly related data base. Verification of the data is performed during this process.

The MINC portion of the CDMS does all data input and verification. Data is then merged into montnly units which are transfered to the 20/60. There, utility programs will merge the monthly units into yearly files and store them on magnetic tape. Further processing of the data can be performed on the 20/60 by, as of yet unspecified processing systems.

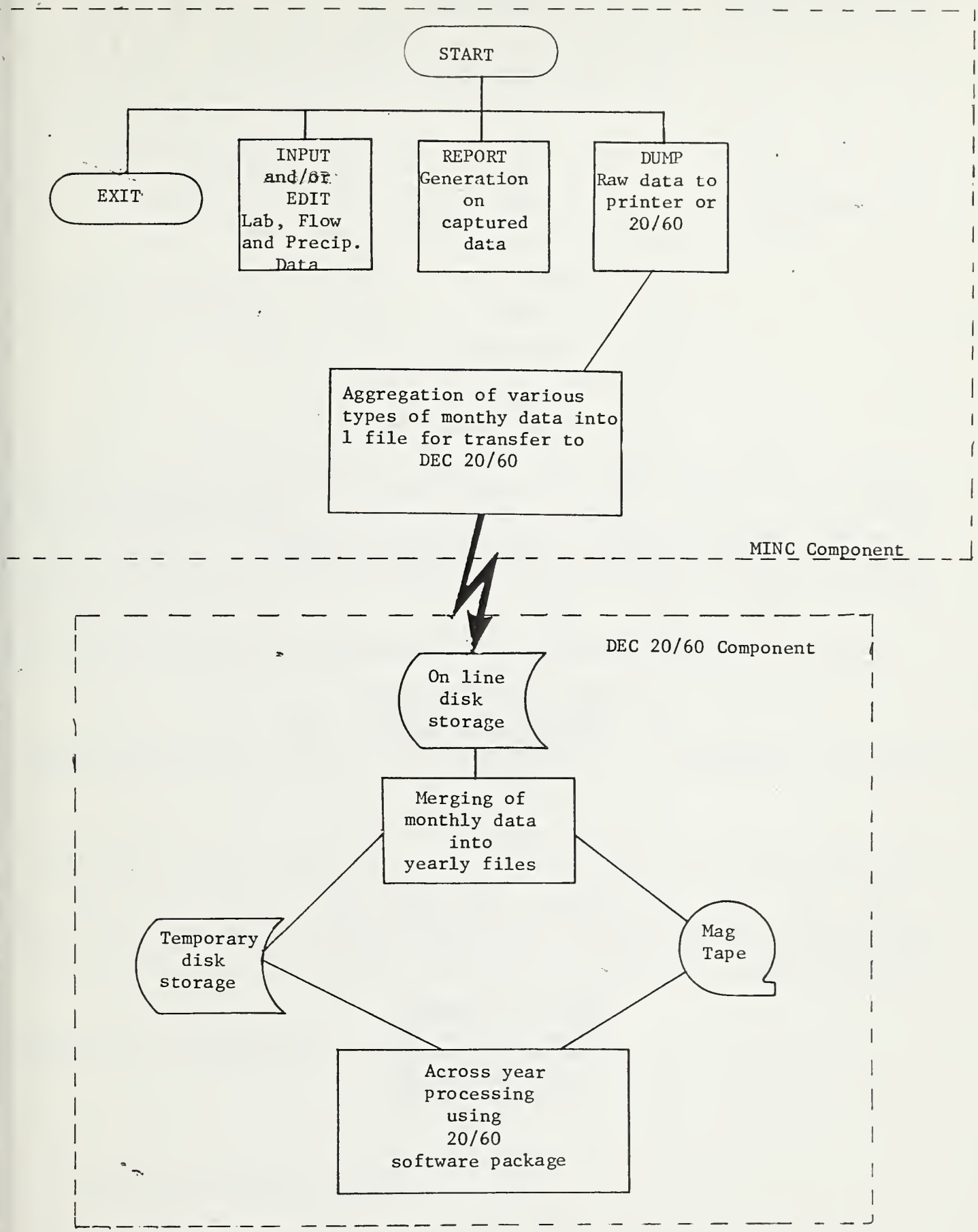
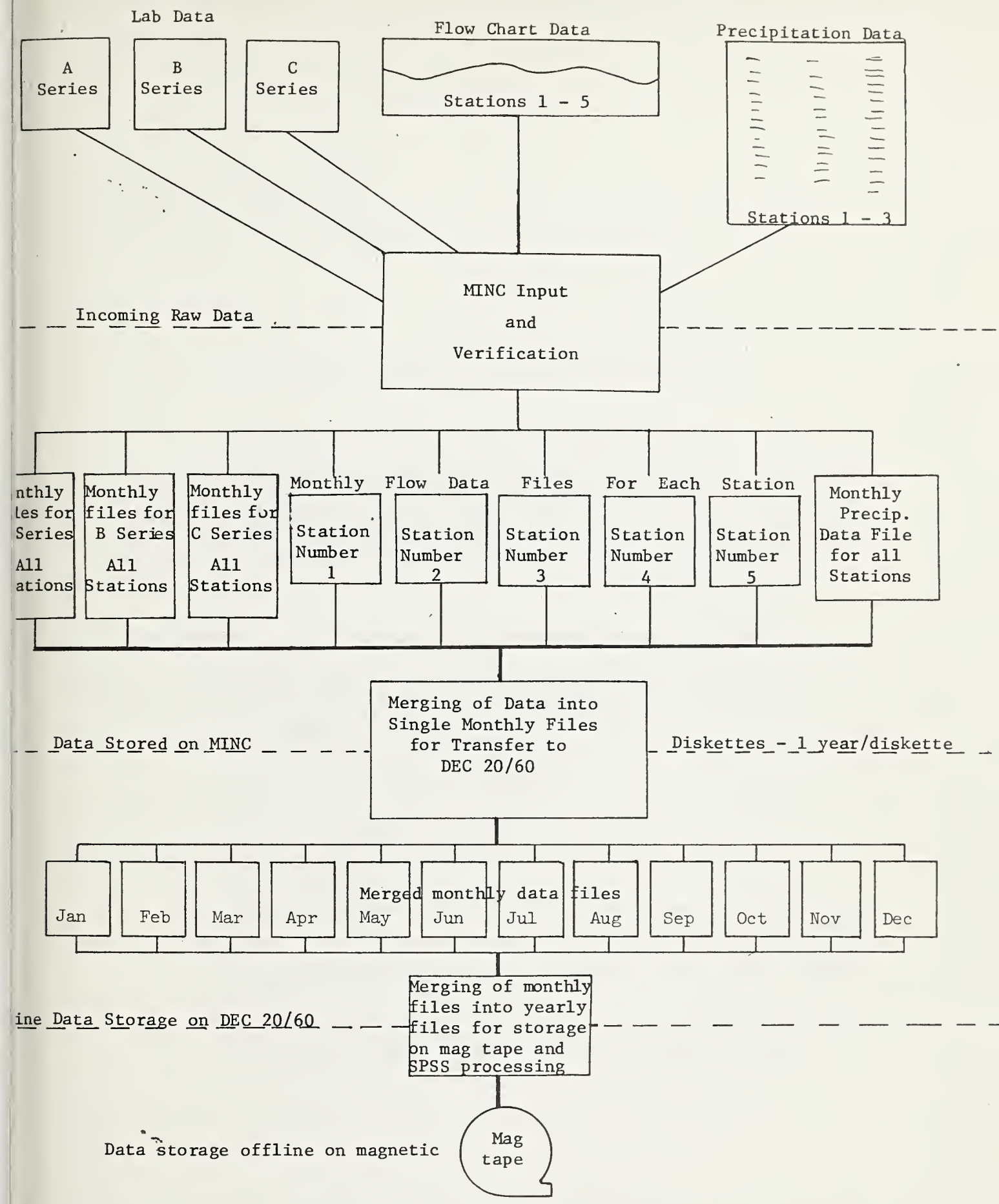


Fig. 1. Overall Logical Organization of CDMS.



ig. 2. Overall Data Flow Through CDMS

CHAPTER 5

MINC-11/03 TECHNICAL SYSTEM ORGANIZATION

As mentioned above, all data handling on the MINC is performed by one menu driven program. This chapter contains detailed documentation of the program modules, programing conventions, file naming conventions, and utility programs. This documentation will consist of flow charts, module definitions, and variable and common area descriptions.

5.1 SOURCE MODULE DESCRIPTIONS AND PROGRAM LOGIC FLOW

All subprograms are listed in appendixes B, C, and D. These can be grouped into the following sets:

- Main Line and BLOCK DATA;
- Input and editing routines;
- Data reporting routines;
- Data dumping routines;
- Routines which allow the user to start a new data disk;
- A single routine which allows lab data limit modification; and
- Those routines which perform single functions which are used in more than one of the above groups.

5.1.1 Common Areas

There are 3 labeled common areas: STRING, LAB, and JUNK. The contents of each are described below.

5.1.1.1 STRING Common -

This common area contains a number of character strings used throughout the program. These are listed and described in Table 1.

Table 1 - STRING Common Variables

Variable	Type	Dimension	Description
ANS	1*1		Used for input of all single character answers supplied by user
BELL	C*1		Contains CTRL/G (bell character)
CLREKR	C*1	16	An escape sequence which saves the current cursor position, clears the error line, and returns to the saved position.
FILNAM	C*1	11	Holds a single file name.
IDATE	C*1	9	Holds current date.
MONTH	C*1	4	String variable which contains a user supplied month abbreviation
MONTHS	C*1	37	Characters for all month abbreviations
VOLID	C*1	12	Holds 12 character Volume ID.

5.1.1.2 LAB Common -

This common area contains data relevant to the lab data. This includes such things as file format information, infomation about data fields, and descriptive text. These are listed and described in table 2.

Table 2 - LAB Common Variables

Variable	Type	Dimension	Description
FDTANM	I	14,3	Data number for each data field in each lab series.
FLDNAM	C*2	10,24	This array contains the names of each of the 24 lab parameters
NMRECS	I	3	The maximum number of records in each lab series file.
RECLEN	I	3	The record length for each lab series file.

5.1.1.3 JUNK Common -

This common block is used as a buffer block. It contains 5684 words, and is equivalenced to variables of the size and type needed in the individual routine.

5.1.2 Main Line And Block Data

5.1.2.1 Main Line -

The Main Line logical flow is illustrated in Figure 3. It serves 3 major functions: displaying the MAIN MENU, making entries into the Audit file, and calls the proper subroutine which controls the selected MAIN MENU function. The major subroutines called are:

HEAD INEUNL RPGNRL OMPUNL NEWDSK MODLIM

These are described in Appendix B. Major variables used are listed in Table 3.

Table 3 - Main Line Variables

Variable	Type	Dimension	Description
BLANK	I		Characters:" "
CCRLF	I		Characters: Carriage return, Line feed
GENREP	I	9	Characters:"GENERATED REPORTS"
IDATE	I	5	Contains date:dd-mmm-yy
INEDTA	I	12	Text:"INPUT AND/OR EDITED DATA"
ITIME	I	4	Contains ASCII time: hh:mm:ss
LOGIN	I	6	Text: "Logged in -"
LOGOUT	I	6	Text: "Logged out-"
LRN	I		The last record number in the Audit file
MAXREC	I		The maximum number of records that can be contained in the Audit file
MODTEM	I	10	Text:"MODIFIED DATA LIMITS"
PROC	L*1		MAIN MENU procedure
STNWDK	I	11	Text:"INITIALIZED A NEW DISK"
USRNAM	I	10	The user supplied name

The CDMS starts execution in the Main Line by calling the subroutine HEAD which displays the welcome salutation. The Main Line then asks the user for his or her name. Next the Audit file is opened, the last record number, and the maximum number of record are read in. The last record number is then incremented and checked against the maximum number of allowable records. A record is then written to the Audit file indicating the Login time, date, and given user name. The MAIN MENU is then displayed and the desired procedure code input and verified. The last record number in the Audit file is incremented and a multiple branch performed on the procedure code.

At each section a record is written out to the Audit file and the appropriate subroutine called. One exception is exiting the system. Instead of a subroutine being called, the Audit file is closed and program execution halted.

Normal program termination is from the Main Line, but due to missing files or internal error checking the system may terminate execution abnormally elsewhere in the program.

After a return from any of the major function routines occurs, the MAIN MENU is again displayed and the above procedures are executed again. See figure 3 for a graphic representation of the Main Line logical flow.

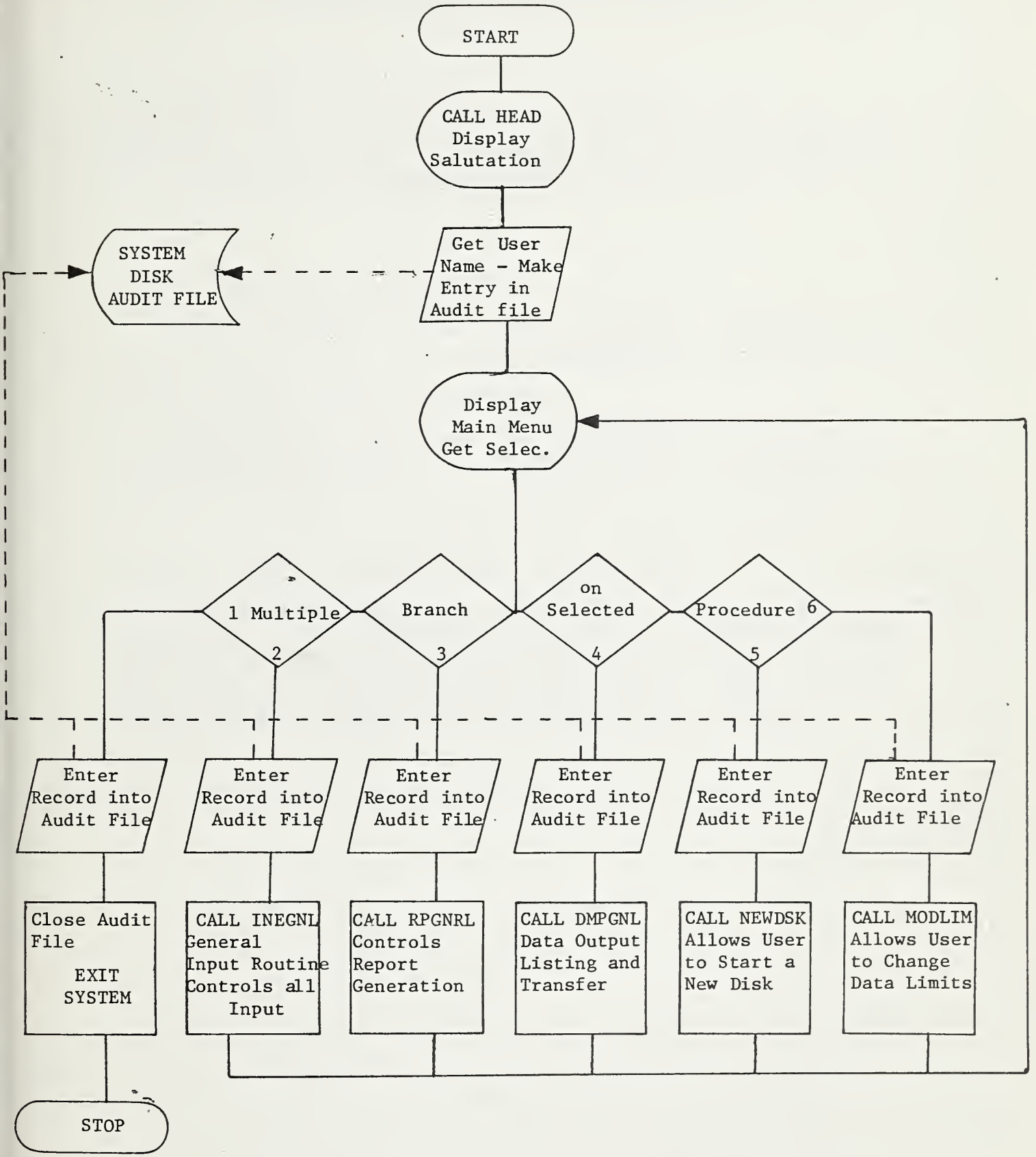


Figure 3. WRRC - CDMS MAIN LINE Source Flow Diagram

5.1.2.2 Block Data -

The block data serves to initialize some of the variables in the STRING and LAB COMMON areas to constant values at compile time. The values in these variables do not change during program execution. See section 5.1.. for variable definitions.

5.1.3 Input And Editing Routines

These routines direct all input, editing, and verification of data. The major input/editing routines are:

INEGNL, INELAB, INEPCP, and INEFLW.

The logical flow for the Input/Editing section is illustrated in figure 4. Each of the major routines are discussed below.

5.1.3.1 INEGNL - General Input And Editing -

This is the general input and editing routine. It is called from the mainline, displays the INPUT/EDIT MENU, determins the desired procedure, and either returns to the main line or calls the correct subroutine. This is a very simple routine which has no major variables. It calls the remaining major Input/Editing routines mentioned above.

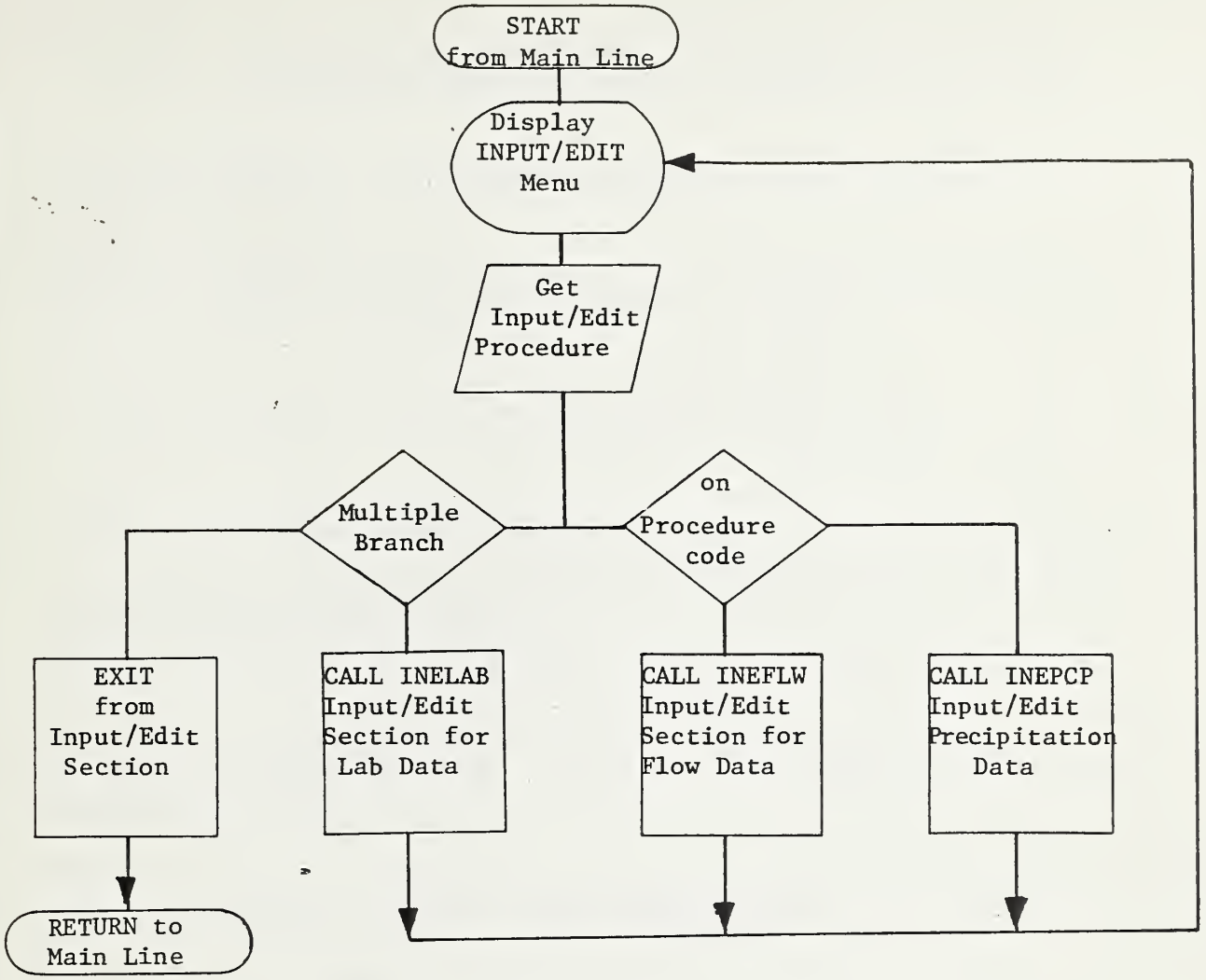


Fig. 4. WRR-CDMS Subroutine INEGNL Source Flow Diagram.

5.1.3.2 INPLAB - Input And Editing For Lab Data -

5.1.3.3 INPPCP - Input And Editing For Precipitation Data -

5.1.3.4 INPFLW - Input And Editing For Flow Data -

5.1.4 Data Reporting Routines

These routines control all data reporting on the WRRC. Major reporting routines are:

RPGNRL, RPLBMN, RPLBUN, RPLBWK, RPPCMG, RPPCMW, and RPPCWK.

The logical flow for the reporting section of the system is pictured in figure 5. The major routines are discussed below.

5.1.4.1 RPGNRL - General Reporting Routine -

5.1.4.2 RPLBMN - Monthly Lab Report -

5.1.4.3 RPLBUN - Unusual Values Lab Data -

5.1.4.4 RPLBWK - Weekly Mean Lab Data -

5.1.4.5 RPPCMG - Monthly Precipitation Gauge Report -

5.1.4.6 RPPCMW - Monthly Precipitation Watershed Report -

5.1.4.7 RPPCWW - Weekly Precipitation Watershed Report -

5.1.5 Data Dumping Routines

5.1.6 Routines For Starting New Data Disks

5.1.7 Data Limit Modification Routine - Subroutine MODLIM

The logical flow involved with modifying data limits is illustrated in Figure 6. Simply, this routine allows the user to make a change in the lab data limit files. There are 2 data limit files and only 1 at a time may be modified. A password is required to make any changes. There are no major subroutines called from this subprogram. Major variables are listed in Table 4.

Table 4 - MODLIM Major Variables

Variable	Type	Dimension	Description
LIMCHR	I	4	Limit characters: LO, LI, HI, HO
LIMITS	R	4	The 4 data limits:low outer, low inner, high inner, high outer
LIMNUM	I		Indicates which of 4 limits for a particular variable is to be modified
NEWLIM	R		The binary new data limit
NWLMCH	C*1	10	The character new data limit
PASS	C*1	4	Equivalenced to USRPAS to achieve character access
PASWRD	R		Stored password
USRPAS	R		User supplied password
VARMOD	R		The variable mnemonic to be modified
VARNAM	R	24	List of variable mnemonics
VARNUM	I		Variable number to to be modified

MODLIM is called from the Main Line. It first asks the user for the password. This is masked when entered. The user supplied password is then checked against that which is stored with the variable PASWRD. If an incorrect password is given a RETURN to the Main Line is performed.

Once a correct password is given the user is asked to specify which of the 2 limit files (see section 5.2.3.2) he or she wishes to modify. The variable mnemonics are then displayed and the correct file opened.

Next the mnemonic for the corresponding variable which is to be modified is entered. If "MM" is entered a normal return to the Main Line is performed at this point. The mnemonic is converted to a number by searching through a list of mnemonics. This corresponds to the record number in the limit file. The limits for the specified variable then read from the file and displayed on the screen.

Now the user specifies which of the 4 limits he or she wishes to change, or if none the user may chose another variable. If a limit is selected the current value is displayed below its usual position and the user may enter a new value. The new value is checked against the neighbor values to be sure that it is logically correct. If OK the new value is entered into the file and another limit may be modified. See Figure 6 for a graphic representations of the logic flow for subroutine MODLIM.

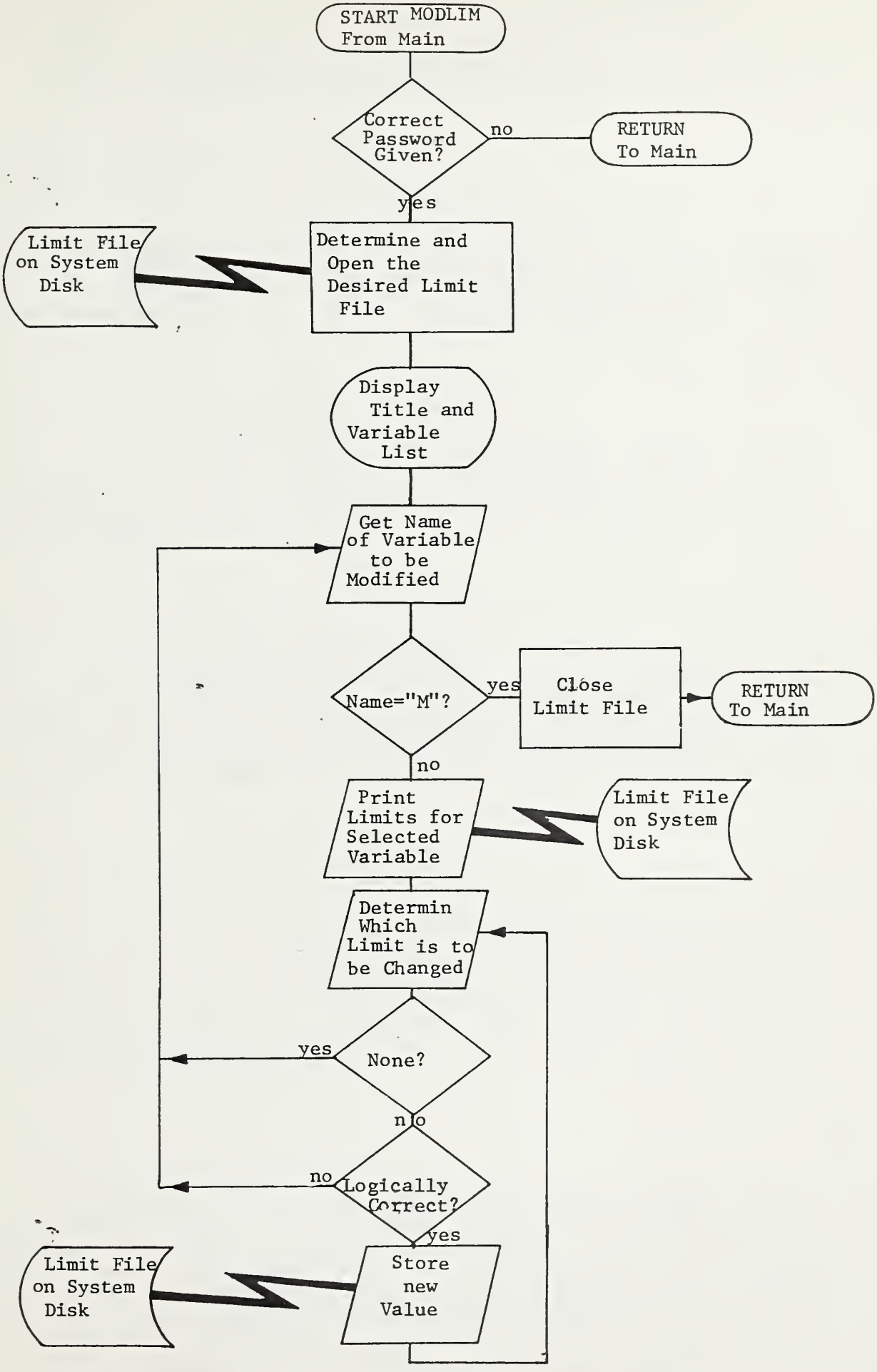


Figure 6. WRRC-CDMS Subroutine MODLIM Source Flow Diagram

5.1.8 Miscellaneous Routines

5.2 FILE AND FLOPPY DISK DESCRIPTIONS

Files are all contained on single sided double density floppy disks each holding 512,000 bytes. All disks related to the CDMS have color coded labels which identify the contents of the disk. These codes are listed below.

5.2.1 BLUE - Development System Disk

This disk contains an RT-11 operating system, FORTRAN compiler, MACRO assembler, subroutine library, MACRO library, KED editor, and assorted system utilities used in developing and/or modifying the source for the MINC portion of the CDMS.

5.2.2 GREEN - CDMS Source Programs

These disks contain all source programs relitive to the CDMS. There are two disks at any one time, one contains the source for the most recent operational version and the other the source for the version currently being developed. These can be identified by the version number written on the label.

5.2.3 ORANGE - User's System Disk

The executable form of the CDMS is contained on this disk. This is the disk that a user would normally use to perform regular system operations. This disk also contains a minimum RT-11 operating system (capable of loading a program, running a program, and doing some file manipulations), the Audit file, data limit files, and CDMS utility programs.

5.2.3.1 Audit File -

The Audit File is written to by the main line. It is an unformatted direct access file. The records are 10 double words long. The number of records in the file is determined when the file is created by the CREADD utility program. The first record of this file contains the number of the next record and the maximum number of records that

can be contained in the file.

When a person starts the system an entry is made into the file indicating the name given by the person as well as the time and date the system was started.

From that point on, each time a selection is made from the MAIN MENU, an entry is made into the Audit file indicating the operation selected. The Main Line indicates to the user when the file is full and stops execution of the program. At that time the system manager should obtain a hard copy of the Audit file for his files and then create a new one using the CREAUD utility program.

5.2.3.2 Data Limit Files -

Data limit files are used for checking the values entered for lab data. The system disk contains 2 of these files, 1 for stations 1-4, and 1 for station 5. The file names are LIMIT1.DAT and LIMIT2.DAT. These are unformatted direct access files each containing 24, 4 double word records. Each record contains the low outer, low inner, high inner, and high outer limit for a particular data parameter. The parameters and corresponding records are listed in Table 5.

Table 5 Limit File Contents

Record Number	Lab Data Parameter
1	TPA
2	TRBA
3	SSA
4	TPB
5	TRBB
6	SSB
7	PO4P
8	TKN
9	NH3
10	NO23
11	TVS
12	COD
13	PH
14	DO
15	COND
16	TC
17	FC
18	FS
19	T
20	STATION NUMBER
21	SAMPLE NUMBER
22	DATE
23	COLLECTION TIME
24	COMPOSITE INTERVAL

The limit files are originally created by the CRELIM utility program. They can be modified by the MODIFY Data Limits function of the CDMS. Naturally if the files are recreated, any changes that might have been made will have been lost.

The data limit files are necessary for the functioning of only certain CDMS functions. These are: Input or Edit Lab Data, MODIFY data limits, and generating the Unusual Values report on lab data. If either of the files are missing while trying to execute any of these functions the program will stop execution.

5.2.4 DDLD - Data Disks

These disks contain data input through the CDMS. Each disk contains one year's worth of data. If the disk has been started it will have the year written on the label. The year is also noted in the volume ID of the disk. This

is done during the "Start a new disk operation" of the system. The volume ID is a 12 character string: DAyy-ddmmmsy. where :

- DA = An indicater that this is a data disk
- yy = The year from which data on this disk is from
- ddmmmsy = The data on which this disk was started

The volume ID can be obtained with the directory command of RT-11.

There are 3 groups of files, those which contain Lab data, Flow data, and Precipitation data. All of the files are unformatted direct access files. Their parameters are listed in Table 6, and they are further discussed is the following 3 sections.

S 1.LT

Table 6 - Data file summary table

CJL Can't justify line
on output page 5-15; on input line 50600 of page 1 of file "DSK:TEC.RNO"

Record Number File Number Maximum

File Length of Size of Stations Files

Group (double words) Records (blocks) per file per Disk

CJL Can't justify line
on output page 5-15; on input line 51000 of page 1 of file "DSK:TEC.RNO"

LAB A 7 30 2 5 12

LAB B 13 196 20 5 12

LAB C 11 81 7 5 12

FLOW 24 31 6 1 60

PRECIP 12 93 9 3 12

CJL Can't justify line
on output page 5-15; on input line 51600 of page 1 of file "DSK:TEC.RNO"

ELD .END LITERAL doesn't follow .LITERAL
on output page 5-15; on input line 51000 of page 1 of file "DSK:TEC.RNO"

5.2.4.1 Lab Data -

There are three types of lab data: A, B, and C series. They are kept in separate files. There is one file for each month yielding 36 files for lab data. The file names are of

the form sLommm.DAT. Where s is the series type (A, B, or C) and mmm is the month for the data. The files are all unformated direct access files with different record lengths and file lengths for each lab series. These are listed in

table 6.

Each record, regardless of the file, contains 6 INTEGER*2 values followed by a variable number of REAL*4 values. These are 3, 9, and for A, B and C series respectively. The first value is not part of the lab data, but is used by the program to indicate the logical end of file. All those records which do not have data on them have this value set to a number < 0. The remaining 7 integer values make up the Sample ID for each sample: <Station # - Sample # - Sample Day/Sample Month/Sample Year - Sample Time (24 hour clock) - Composite Interval (0 for a Grab)>. The other data values are different for each series. The contents of the remaining data values for each series are:

SERIES A: TPA, TRBA, and SSA
SERIES B: TPB, TRBB, SSB, PO4P, TKN, NH3, NO2,3, TVS, and COD
SERIES C: pH, DO, CONDC, TC, FC, FS, and TEMP.

The data is maintained in sorted order by sample #. This is done by the input and editing routine for lab data.

5.2.4.2 Flow Data -

Flow data are stored in 5 files per month, one file for each station. This yields 60 flow data files on each disk. They are created as needed. The file names are of the form: srWmmm.DAT, where s is the station # and mmm is the month from which the data originates.

The files are unformatted direct access files containing 31 records each. The records correspond to the days in the month. Each record contains 24 REAL*4 values. These values are the flow rates recorded at the midpoint of each hour. The relative position on the record indicates the hour. Hence, the flow recorded at 12:30 on the 5th, would be in the 13th value on the 5th record. The files for months with < 31 days have the values for the unused records set to -999.0.

The program is set up in such a way that these files will always be completely filled. The user is forced to fill these files when inputing flow data.

5.2.4.3 Precipitation Data -

Precipitation data are stored in 1 file per month. There are three stations but due to the type of analysis that is done on this data, it was more efficient to store all three stations in one file. The file names are of the form: PRCmmm.DAT, where mmm is the month for this data.

These files are unformatted direct access with 93 records in each file, 31 for each station. Records 1-31 for station 1, 32-62 for station 2, and 63-93 for station 3. On each record there are 12 REAL*4 values. The values are the amount of rainfall over 2 hour intervals in inches. Stored values of -999.0 indicate that no data is entered in that position.

5.3 UTILITY PROGRAMS

Utility programs are separate programs used to perform functions such as reading binary files, recreating data limit files, reformating binary files, etc. These will be individually discussed below.

5.3.1 CREAUD - Create Audit File

This utility is used to create a new audit file (see section 5.2.3.2). The program asks the user how many blocks he or she would like to allocate for the file, fills the file with blanks, and sets the first record with the initial values of 1, and the number of records that will fit in the file. This file is created on the device with logical name SY: and destroys the previous audit file.

5.3.2 CRELIM - Create Limit Files

This utility program serves the same function for the data limit files as CREAUD does for the audit file. CRELIM has a set of initial values that it uses when new limit files are created. These were set forth early in the course of this project and should be reviewed when recreating data limit files. The files are created on the system disk, or the device with logical device name SY:. See section 5.2.3.2 for a description of the limit files.

5.3.3 RDLIMT - Read Data Limit File

This utility program is to be used for reading the binary lab data limit files and displaying them on the console terminal. The file contents of LIMIT1.DAT is displayed first followed by that of LIMIT2.DAT. See Section 5.2.3.2 for a description of these files. Individual limits can be viewed and modified through the system by performing the "MODIFY DATA LIMITS" function.

5.3.4 PRJCAL - Project Calander Generation Utility

CHAPTER 6

DEC 20/60 TECHNICAL SYSTEM ORGANIZATION

This section will describe 20/60 command files, tape handling routines, tape libraries, and any utility programs that are used on the 20/60. These are not specified under V5.2.

APPENDIX A

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APPENDIX B

SUBPROGRAM DEFINITIONS

This appendix contains an alphabetical list and descriptions of all subprogram modules in the MINC portion of the COMS.

MAIN LINE - controlling executive program. Makes entries into audit file, and starts controlling subprograms for each major program function.

BLOCK DATA - Sets values of variables in string common.

CALDAT - Converts a day number into a calander date.

CRUTFL - Creates new data files for the Lab data.

DISFLW - Displays a single flow data record using variable format.

DISLAB - Displays a single lab series record using correct format at specified screen position.

GETVOL - MACRO Subroutine which reads the volume ID on the data disk.

GRUCHR - MACRO Subroutine which retrieves specified number of characters from console terminal without a RETURN.

GRUDIG - MACRO Subroutine which retrieves a group of 8 characters from the digitizer.

HEAD - Displays initial message at system startup time.

IDAYMN - Calculates the number of days in the given month for the given year.

IDAYNM - Converts a calander date into a day number.

INDIG - Handles gathering a section of flow chart input from the digitizer. Makes sure flow values aren't missed or repeated.

INFLW - Handles all aspects of inputting and editing flow data.

INFGNL - General input and editing routine. Displays INPUT/EDITING MENU and determines the type of input desired.

INFLAB - Handles input and editing of lab data.

INFPCP - Handles input and editing of precipitation data.

LIMCHK - Routine which checks the lab data against data limits stored in the limit files.

MNTHYR - Function which obtains month and year from user of data to be entered or of desired reports. Year and month are verified, and data disk is checked.

MODLIM - Does modification of data limits.

NEWDSK - Allows user to start a new disk.

PRJDAT - Converts a daynumber into a project date - year number, week within year, and consecutive week.

PUTVOL - Writes out a volume ID onto the data disk.

RPGNRL - General report generation routine. Displays REPORT MENU and determines the desired report.

RPLBMN - This routine generates the monthly lab report for A, B, and C series data.

RPLBUN - Generates report on lab data indicating unusual data values.

RBLBWK - Generates report on lab data giving weekly means for a specified range of time.

RPPCMG - Monthly precipitation gauge report generation routine.

RPPCMW - Generates monthly precipitation watershed report.

RPPCWW - Generates weekly precipitation totals by week for each watershed.

SYSTEM SUBROUTINE LIBRARY - This comprises a group of

routines which are used throught the CDMS but are part of the RT-11 System Subroutine library, or part of FORTRAN under RT-11. These are listed in Appendix C.

VTLIB - This is a library of macro routines which drive the VT105 terminal. These are described under Appendix D.

APPENDIX C

VTLIB - LIBRARY OF VT100 DRIVING ROUTINES

VTLIB is is a set of MACRO-11 subroutines which are used to control the VT100 or VT105 terminal. These were obtained through a DECUS publication (9). There have been a few minor modifications and additions, but generally they are used as published. The routines generate escape sequences which perform the desired terminal function. The routines used are described below.

BIGBOT - Makes the current line the bottom half of a double height line.

BIGTOP - Makes the current line the top half of a double height line.

BLDVID - Makes next characters **bold** video. (Added)

BNKVID - Makes next characters blinking video. (Added)

CLRALL - Clears entire terminal screen.

CLRBEG - Clears begining of current line.

CLRBOT - Clears from the cursor to the bottom of screen

CLREND - Clears end of current line.

CLRLIN - Clears current line.

CRLF - Generates a carriage return line feed.

CUB - Moves the cursor back specified number of spaces

CUF - Moves the cursor forward specified number of spaces.

CUP - Moves cursor to specified line and column.

DGS - Deselects the graphics set of characters

DWL - Makes the current line double width.

IND - Moves down one line with scrolling.

NEGVID - Makes next characters negative video.

RESVID - Makes next characters regular video. (formerly POSVID)

RESCUR - Reset the saved cursor parameters.

RI - Reverse index - Moves up 1 line with a scroll.

RM - Reset mode - Resets any of the terminal modes e.g. 132 column mode.

SM - Set mode - Sets any of the terminal modes.

SAVCUR - Saves the cursor attributes and position.

SGS - Select graphics character set.

STBM - Sets the top and bottom margin of the terminal scrolling area.

APPENDIX D

SYSTEM SUBROUTINE LIBRARY

These subprograms are used throught the CDMS but are part of either the System Subroutine Library, or the FORTRAN Subprogram Library. They provide various standard functions such as aquiring the current date ane time. Those used are listed and described briefly below. For more detailed information see the RT-11 Advanced Programer's User Guide(3), and the RT-11 FORTRAN IV User's Guide(4).

DATE - Returns the system date.

INDEX - Returns the starting location of a string pattern occurring in a string source.

ISIGN - Integer transfer of sign.

TTOUR - Transfers 1 character to the console terminal.

MTATCH - Attaches a specific multi terminal.

MTUTCH - Detaches a specific multi teminal.

MTSET - Sets status information for a specific terminal.

PRINT - Outputs an ASCII string to the terminal.

SCCA - Inhibits a CTRL/C abort.

SQRT - calculates square root of argument.

SUBSTR - Copies a substring from a specified string.

TIME - Returns the system time.